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BENEFITS OF SPACE TECHNOLOGY

by

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to

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Within a span of six months the world has witnessed some remarkable American space flights. Last November, Schirra, Eisele, and Cunningham circled the earth for eleven days in Apollo 7. Last Christmas, Borman, Lovell, and Anders made their historic flight around the moon in Apollo 8. Now, McDivitt, Scott, and Schweikart have just completed the Apollo 9 flight where they operated the "Spider," the moon lander, in flawless maneuvers and docking.

Within the span of another six months, NASA plans to land astronauts on the moon and return them safely.

To many, these flights are the culmination of an extraordinary eleven years of space successes, a period when American space flight capability grew from the simple grapefruit-sized Vanguard satellite to the complex manned operations of Apollo. It has been a period of great expansion of space science and technology. We have greatly increased our understanding of the earth, its space environment, and of the moon, as well as probed the environment of Mars and Venus. We have world-wide communication and meteorological networks using satellites. We have large teams of scientists and engineers with facilities capable of building, testing, launching a wide variety of boosters and spacecraft, and other teams engaged in many types of space experiments. These people are geared up and eager to embark on new endeavors as challenging now as man landing on the moon was at the beginning of the decade.

Written by John L. Sloop:jd

To others, however, the conclusion of the Apollo mission will be applauded not on its merits as the greatest of all man's technological achievements, but because it signals the end of a huge spending program. They do not see the value of the effort in terms of today's needs. Other more immediate problems have demanded attention -- the war in Vietnam, poverty, the crowding in our cities, pollution of our streams and air, our clogging transportation system, and rising crime. Indeed, many opinion polls show that the space program is the target for reduced spending or reduced priority.

It is clear, therefore, that we are rapidly approaching the time in the space program when new national goals must be set that are in keeping with current and future needs. President Nixon has established a task group to make recommendations on the direction which the U.S. space program should take in the post-Apollo period. It is to report to him on September 1. Vice President Agnew is Chairman of the task group with the Secretary of Defense, the Acting NASA Administrator, and the President's Science Advisor as members.

As a former businessman who has just about completed a tour of duty with NASA, I would like to make a few observations about the space program, and a suggestion.

First, I believe the time has come to pay greater attention to the many social and economic benefits that are possible through the use of space technology. I believe it is a sound investment that will bring handsome returns for the dollars invested. It is still in its infancy, but already meteorological forecasting has taken a giant step forward using satellite observations. Early warnings of hurricanes discovered by satellites have saved lives and millions of dollars in property damage. Following Hurricane Naomie and torrential rains last November, Mexico used satellite pictures to make a tough decision that saved two cities from possible disastrous flooding, and saved a badly needed water supply. Just recently, the hospital ship, Hope, battered by a storm and uncertain as to which direction to go for safety, radioed for satellite data and received it. It has been estimated that weather forecasting will, by the mid-seventies, be so improved that it might save as much as \$15 billion lost annually in food harvesting. Even half this amount would be a significant return on the money invested in the space program.

Already, communication by satellite is a growing commercial business able to stand on its own feet, buy its satellites, pay for launchings, and earn money. Its stock is traded like other stock with investors buying for its earnings and not because they are dazzled by space glamour. Many feel that we are at the threshold of a revolution in communications, and that in the seventies we will have domestic and international television direct from satellite to communities or homes, telephone communications to all parts of the earth, world-wide business data transmission

systems, world-wide library and information services, ship and airline navigation and traffic control, and educational systems that reach all the peoples of the earth. The worth of these is incalculable just as it is impossible now to calculate the worth to society of the modern telephone system or the modern air transportation system. It is such an integral part of our lives that it defies a price tag.

Already, research is showing the potential of surveys of the earth by satellites that will help locate new sources of oil or minerals, conserve resources, monitor pollution, and help increase food production.

Second, we need to continue building a strong base of space technology, not only as a prerequisite to future space missions but also because the same types of technology are basic to many activities here on earth.

One of these basic technologies is energy conversion, and, particularly, electric power generation. The need for efficient, lightweight, and compact sources of electric power for space has resulted in a step-up in research on conversion methods such as the fuel cell systems of Gemini and Apollo, radioisotope thermoelectric generators, and battery solar cells for other spacecraft. Future systems will use nuclear power and employ turbogenerators, thermionic, and magnetohydrodynamic conversion methods. The requirements for space power are similar to those for remote areas on earth such as the polar regions, islands, mountains, jungles, and the oceans -- so we can expect a spreading use of this technology.

Space power technology also has much in common with technology employed in this country and abroad, including nuclear electric power generation, steam and gas turbines, and related equipment. Nuclear electric power generation is on the rise in the United States. By mid-1968, there was more than 65,000 megawatts of capacity, more than the nation's entire electric production 20 years ago. By 1980, power capacity is expected to be more than double the present level with about a third of it coming from nuclear generators. Although only a few large companies market the nuclear reactors, there are more than 400 industry units identified with this business. There are probably even more businesses involved because the many components needed require a wide range of equipment suppliers. The value of engines and turbines for powering a multitude of devices is almost a \$4 billion business and growing rapidly.

A small but growing item is the rechargeable battery, the development of which was stimulated by space needs. These batteries now power many portable tools and devices in everyday living. Sales of nickel-cadmium batteries has grown from a low value six years ago to over \$20 million a year and is expected to more than quadruple within five years. NASA is now conducting research on rechargeable batteries with a life of five years as a goal.

There are other parts of space technology applicable to many industrial processes. Among them are materials for machinery, energy conversion, structures and electronics for sensing physical or life phenomena, storing, computing and handling data, controlling complex operations, and communications.

Third, the environment of space offers a unique opportunity for research on physical and life processes. I refer to weightlessness, the near perfect vacuum, and the closed environmental systems which will give us a new insight into many processes and enable us to conduct experiments with ease that are either impossible or very time consuming to do on earth.

Fourth, the rapidly moving cutting edge of space science and technology is laying bare a treasure of potential innovations that are of immense value to big and small business alike. It is there for the taking for those who are alert to the possibilities. You will hear more about many of these innovations from the speakers this afternoon.

NASA has a vigorous program to promote the transfer of space technology to the private sector. Its cornerstone is a modern information system for reaching all segments of industry and education in several forms. One of these is the "Tech Brief," which describes an innovation and tells you how to get more information. Over 2500 innovations have been described and over a quarter million copies have been distributed. Sales of other publications with more details are at the hundred thousand mark.

There are six regional dissemination centers to serve the needs of those who seek their services, and there are teams in specialty areas such as bioinstrumentation and computer software.

There are conferences large and small to bring space technology to the attention of interested business and professional groups.

I have had the opportunity to observe NASA's Technology Utilization Program as a businessman and as a NASA official. It has done an outstanding job in government of bringing technical developments to the attention of those who can use it. Their success at this has been recognized by other agencies of the government. The President's Office of Science and Technology has asked NASA to be the lead agency in giving businessmen a better understanding of how they can obtain Federal research and development results.

I want to close with a suggestion to you as businessmen. Communication is a two-way affair, and business could do more in seeking to learn and assimilate the results of research that is in the public domain. To do this it will be necessary to go beyond the normal channels of communications of meetings and publications. You must get to know the work on a

more detailed basis. Encourage more visits by your technical people to government laboratories, and establish a more personal relationship with the NASA Centers. There are many possibilities for doing this which I will not try to outline here. I believe that only by making a determined effort will businessmen learn more about what is going on in government-sponsored R&D and be able to reap the full benefits of this rich field.

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